USER INVOLVEMENT AND USABILITY EVALUATION IN ETHIOPIAN SOFTWARE ORGANIZATIONS

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ABSTRACT
Usability is central especially in contexts with highly heterogeneous user groups as it is the case in developing countries. User involvement and participation has positive impacts towards developing usable software and system success and it is one of the core principles in user centered design (UCD). But how does the industry in developing countries work with UCD and usability evaluation? The article reports from a survey on usability evaluation and UCD practices in Ethiopian software organizations. It aims at exploring the practice of usability evaluation, user involvement and participation in the software organizations in Ethiopia. Some part of the survey question is adapted from a previously conducted survey in Italy and Denmark and further expanded with a set of questions referring to user involvement and participation. The survey was triangulated with interviews with a subset of the respondents. The results show that the percentage of organizations performing some form of usability evaluation is low in Ethiopia. The challenges of usability evaluation observed in the study was analyzed with respect to the challenges of 'digital divide' against the publicly available methods and practices and among developed and developing nations using real access/ real impact criteria. The result shows that there are some unique challenges of usability not discussed in the literature reviewed in any detail such as less IT skills, lack of trained professionals, and lack of awareness. The result for user involvement shows also some unique challenges: lack of user motivation, acceptance of change and cultural influence. However, more than 80% of the surveyed organizations claim involving users in some kind in product development. The implications of these findings with respect to the need to contextualize UCD and usability methods are discussed.

KEYWORDS
Usability Evaluation, User Involvement, Awareness, Skill, Context, Culture

1. INTRODUCTION

In many cases in developing countries IT services are leapfrogging paper based administration. Outside of the cities and the capital, part of the population is illiterate or semi-literate. Addressing usefulness and usability of software systems is of core importance to the people in such context. Ethiopia is here no exception (Teka et al., 2016).

Human Computer Interaction (HCI) is a well-established sub-discipline of computer science and provides a whole bandwidth of methods for user centered design (UCD) and interaction design. (See for example the course book on interaction design (Preece et al., 2015). Two central elements are user involvement and usability evaluation. Even if HCI provides important UCD and usability methods, these methods lack predicting dynamic and

changing behavior and needs of users and consideration of the complex socio-economic and cultural situations and heterogeneities existing in developing countries for sustainable design and development.

Though it is not originated from the fields of HCI or UCD, the Real Access and Real Impact (RA/RI) criteria consists of a set of guidelines useful for user centric design to contextualize to the developing world (Bridges.org, 2005). It describes real access to Information and Communication Technology (ICT) as access that goes beyond just physical access and to make it possible for people to use technology effectively to improve their lives. Real access (RA) criteria set by the digital divide (Bridges.org, 2005) consists of local economic and environment as a condition for technological impact among others. It puts discussions beyond the need for human capacity and training: '*any technology will be insufficient if people do not understand how to put it to effective use as part of their lives or their work, either because they are not trained to use it, or they cannot imagine the possibilities for how they could use it. People will be encouraged to use ICT only when it is apparent to them that it will have a positive impact on their daily lives'*. The RA criteria aim to highlight sensitive and critical issues that need to be considered from the developing world perspective. The implication of RA/RI criteria is that usability and hence UCD and user involvement are central parts in the development of ICT and the focus of the article on RA/RI is that it is because it seeks implications for building technology to technologically far people.

For method developers, practitioners do not always follow what is recommended in methods (Fitzgerald, 1998). Learning from local and contextual development practices requires good understanding of how practices are implemented and used in the targeted context of development. The contextual practices and their improvements should bring a meaningful change in the practice and moreover the contextual impacts after a practice has been introduced or changed need to be studied for reflection and learning towards method development. The sociocultural, skill heterogeneities and economic situations determine what usability and UCD method to adapt.

The enquiry for understanding the local practice and challenges then lead to asking the question: what are the usability challenges and how does the software industry address these usability challenges? And what are the practices, the experienced benefits and challenges of user involvement and usability evaluation in Ethiopia? The article further enquires what kinds of insights can be found for improved and adapted user involvement and usability evaluation from the observations and the practice.

The article is organized as: in Section 2 the related work is presented to help relate the result with the state of the art, Section 3 discusses practice theory appropriated for software engineering to discuss methods in use in practice, Section 4 discusses culture in relation to its impact on ICT development, usability evaluation and user involvement, Section 5 describes the research method, while in Sections 6 & 7 the result of the survey on usability evaluation and user involvement is presented respectively. Finally, in Section 8 discussions in relation to related works, conclusions and future implications are presented.

2. RELATED WORK

User involvement and usability evaluation are two cornerstones of UCD. Usability evaluation is usually considered easier because it may not require long term interactions with the user or it might be performed without user involvement, like the heuristic evaluation. User involvement is the more expensive and the more difficult task to do than usability evaluation. The related work is reported in two sub-sections. Sub-section 2.1 presents the related work to user involvement and participation and sub-section 2.2 presents the related work to usability evaluation

2.1. User Participation and Involvement

Document reference is insufficient and direct contact with users is essential to build usable product. If users are contacted only for user acceptance testing, operational testing or only during deployment, one may run into the danger of building wrong product or incurs high cost of modifying the product. This has been supported in the literature that involving users early in the development is efficient and influential as the cost involved in making changes increases in system development (Noyes et al., 1996).

Many literature and also practitioners did not differentiate between customer and end users especially when it comes to involvement and participation in software development. Customers/clients and users have different motivations in product development, however, they have overlapping roles and both are important information sources and stakeholders in the development project. Customers finance the project and users are experts of the system or domain experts.

User participation and involvement has been reported to have a positive impact on the system success (Abelein & Paech, 2015; Bano & Zowghi, 2013; Kujala, 2003). Specifically, Bano and Zowghi reported that the relationship between user involvement and system success is not simple and it depends on many factors and conditions surrounding the system development process, such as size and type of organizations and projects, data collection method and phases of system development life cycle when data was collected, user involvement or participative approach followed in system development, such as agile, UCD, participatory design (PD) and the like. Earlier research supports that involving users early in the development is efficient as it reduces the costs involved in changes and redesigns late in the software development (Noyes et al., 1996). Especially the research in Participatory Design has developed a broad range of tools and techniques (Simonsen & Robertson, 2013).

In order to understand users and their requirements and develop a system that supports their job, end users should be involved throughout the development lifecycle, as it has also been stated as one of the principles in the standard ISO 9241-210:2010 (ISO 9241-210:2010, 2010). However, there are many difficulties associated with involving users to elicit their requirements and many developers also do not know how to involve users, or if they do, they do not utilize them to best effect (Noyes et al., 1996). Developers also ask what the role of users should be if they are involved in software development.

Abelein and Paech (2015) show that only a little attention is given to the influencing context factors. As a result, the authors asked for more empirical research on aspects of user participation and involvement in various contexts. Their study reveals that more of the user participation and involvement is on the requirement elicitation and validation phases and only a few methods focus on user participation and involvement in the software design and implementation activity, even though within these activities many important decisions are taken.

In most organizations, the role of users in design projects is not clearly presented. Users are therefore found confused and consider themselves as lacking expertise in involving and operating the system provided (Damodaran, 1996). For real user participation and involvement, instead of prescribing methods and tools, closely understanding the structure of the organization and holistic understanding of local conditions will always be necessary for guiding the representations and involvement of users.

Sometimes users are involved as providers of information to the project team. In such projects, users contribute to the project but do not influence key decisions and it is one cause of failure of projects and failure of IT development to reflect adequately for real human and organizational needs (Damodaran, 1996). Damodaran (1996) characterized forms of user involvement as falling somewhere between: '*informative*' (users provide or receive

information), '*consultative*' (users comment on a predefined service or range of facilities) or '*participative*' (users influence decisions relating to the whole system).

Some of the documented benefits of effective user involvement in system design are (Damodaran, 1996): improved quality of the system arising from more accurate user requirements, avoiding costly system features that the user did not want or cannot use, improved levels of acceptance of the system, greater understanding of the system by the user resulting in more effective use and increased participation in decision making in the organization.

2.2. Usability Evaluation

User involvement is often regarded as costly in terms of effort and access to users. Usability evaluation involves techniques that do not necessarily require access to the intended users of the software (Preece et al., 2015), however, the techniques cannot substitute evaluation with users. Indeed, there are cost-effective methods, such as usability inspection including heuristic evaluation from discount usability engineering, which only requires experts of usability who evaluate the software products with respect to well-known usability principles (Bias & Mayhew, 2005; Nielsen, 1993). Related research indicates that HCI/UCD and usability methods are developed within the context of developed countries and might not fit for the developing country's context and experience (Maunder et al., 2007; Preece et al., 2015). These publicly available methods need to be appropriate and adapted to the context of the use situation and the environment. For example, usability heuristics methods developed by Nielsen (Preece et al., 2015; p. 27) are developed with respect to the western context and experience and adopting as they are to the developing world does not work. This is confirmed by our study detailed in sections 6 & 7 that usability evaluation is difficult because of lack of IT expertise by intended users and cultural differences. With other words, aspects mentioned in the RA/RI text are becoming visible as challenges in our study.

Usability is a measure of the extent to which prospective users are able to apply a system in their activities. Furniss et al. (2007) claim that the current literature fails the usability practitioner because it is focused on the number of problems they find to evaluate usability evaluation methods, which is inappropriate to practice. Instead, they argue for an approach which is more fitting with the values and constraints of practice more orientated toward business and engineering.

Usability evaluation comprises a set of methods including usability testing with users, interview and survey methods. The details of the methods can be found in (Nielsen, 1993). In some organizations, these methods are applied out by dedicated usability professionals, while in other organizations, they are carried out by the software development teams. Specific methods suitable for people who are not expert evaluators are defined (e.g. Lanzilotti et al., 2011). Companies are investing resources to evaluate functionality of their software product. A low level of usability means that users cannot work out how to use a system, no matter how elaborate its functionality is (Nielsen, 1993). There are studies that indicate that software development organizations perform little or no usability engineering activities (Ardito et al., 2011; Bak et al., 2008). Some of the documented benefits of evaluating the usability of software products are increased sales, increased user productivity, decreased training costs and decreased user support (Kujala, 2003).

Research by Winschiers-Theophilus (2009) and Zewge et al. (2015) indicate that not only design of the user interface, but also the design methods themselves need to be adapted to the socio-cultural context in which they are deployed. Likewise, research by Biru (2008), and Oyugi et al. (2008) indicate studies in Europe and North America might only tell little about the practices in developing countries relating to a different context. Besides cultural differences, differences in application requirements, jobs and work environments, attitudes

and behaviors in the workplaces, organizational structures are mentioned (Biru, 2008). Furthermore, lower IT skills of the intended users compared to the developed countries bears influence in usefulness of design methods and usability of the products. Doerflinger and Dearden (2013) indicate that also technical ICT development methods would need to be adapted to the infrastructural and cultural contexts. Indeed, the authors propose a close collaboration and cooperation between project stakeholders and emphasize a systematic approach to study end users instead of relying on researchers who are new to the local community.

An earlier study published in 2008 shows that most of the software organizations in Ethiopia are young start-ups and inexperienced; the software industry is in its early stage (Biru, 2008). The study reported that there are no methods available that support the local software industry, and recommends developing contextually adapted software development approach. Another local study in 2012 (Dino & Bekele, 2012) reported that only a few organizations follow some form of approach such as waterfall, iterative, agile etc. From the few organizations surveyed, Dino and Bekele reported that usability testing is confirmed by 56% of the respondents, it though is informal, for example collecting feedbacks and comments via telephone conversation. Her study is limited as it considers only a few of the organizations (Dino & Bekele, 2012; p. 33).

Also, the context in which the software companies operate is constraining: In Ethiopia, the software procurement has to meet the requirements of federal public procurement directive (FPPD), which is responsible for all public procurement including, for example, engineering and office equipment procurement, and which is very rigid (Aregawi & Lemma, 2013). According to Aregawi and Lemma (2013), 82% of the customers of software providers are government organizations who adapt the FPPD. He reported on the opinions of software developers that software has to be revised over and over again after deployment as the experiences with the usage leads to requirement changes, which in turn increases the cost and time of development. With this regard, the Twelve's criteria of the RA/RI (Bridges.org, 2005) is to have 'political will and public support'. Most developing countries take the ICT as a driving force and enabler for economic development. However, due to lack of economic power, they often try to meet the short term demands of their constituencies. ICT policy failing to have appropriate software procurement and failing to motivate to work on user centric issues and usability, taking, for example a failure to consider explicit usability requirement in the call for tendering (CFT) documents may affect software organizations and stakeholders from taking the necessary actions.

Methods need to be adapted to the specific context and use situation where they are deployed. The study has been undertaken to explore to get a more recent, representative overview over how software organizations in Ethiopia address usability and user involvement and what benefits and challenges are experienced.

3. PRACTICE THEORY

Software development is a social practice where important development practices remain tacit to the development team and individuals involved in the development. The term practice theory informs the routinized and performative character of action, its dependence on tacit knowledge and implicit understanding. It explains how people develop practice over time. Practice is defined as normatively regulated, contingent activity (Schmidt, 2014).

In their discussion of the practice of testing, Martin et al. (2007) criticized that SE research has largely focused on technical terms, designing and building tools. They argue instead that in practice the key issue is how to design tests that are most effective in satisfying organizational needs and that minimize the effort and time required to demonstrate that software is 'good enough'.

Taking the practice of testing as a case, in a practice oriented research, it has been shown that inadequate testing leading to system failure are mainly due to the fact that the testing practices are focusing on technology and method ignoring the real world existing practices (Rooksby et al., 2009). Rooksby et al. argue that testing does not simply focus on technology alone but also on socio-technical issues such as acceptability, usability, and fitness for purpose. On their ethnographic study, they reported the cooperative and organizational aspects of testing based on the contextual situation supported identification of errors and usability challenges better.

Organizational and project specific practices of testing, quality assurance, requirements development and related practices need to be understood and communicated to inform the proposition and development of methods, concretizing practice. As such software development is a social and epistemic practice and software development method is a practice pattern that should be related and integrated in an existing development practice (Dittrich, 2016).

UCD works closely with potential users. The context and need of users should be closely studied. Practice is not a mere activity. Rather than single interactions or activities, practice theory takes socially shared practices as its main unit of analysis. Therefore understanding software development and usability evaluation as a social practice as in line with the practice theory helps adaptation of usability evaluation and UCD methods to the concrete practice of the context where the methods need to be deployed. One of the reasons for adaptation of the methods is the socio-economic and cultural context.

4. CULTURE

Hofstede in his empirical research categorized national culture along five dimensions (Hofstede et al., 2010). In his research, there were core characteristics of the Ethiopian culture (Hofstede, 2016). Three of the cultural dimensions have been considered here as they are relevant to the discussion: *power distance*, *collectivism,* and *uncertainty avoidance*.

Power distance (PD) is the strength of social hierarchy, is defined "as the extent to which the less powerful members of institutions and organizations accept and expect that power is distributed unequally". *Individualism and collectivism*: focuses on the relationship between the individual and groups. Highly individualistic cultures believe that the individual is the most important unit while highly collectivistic cultures believe that the group is the most important unit. *Uncertainty avoidance* (UA): focuses on the extent to which a culture feels threatened or anxious about ambiguity and how hard individuals will work to avoid it. These variables focus on how cultures adapt to change and cope with uncertainty.

In high PD cultural society, inequality is accepted and subordinates expect to be told what to do. Ethiopia is surveyed as a country with hierarchical culture (high power distance) (Hofstede, 2016). There is unequal distribution of power in everyday life which is accepted. Individuals at the top and bottom of the relationship are considered normal and complementary. Ethiopia is also surveyed to be a country with high collectivist society and high index of UA (Hofstede, 2016). A high value of UA index for Ethiopia is indicating that the society does not respond to change in all aspects of life, cautious and reserved, prefer low risk and changes take place slowly.

Culture has influence over software development and use (Hofstede et al., 2010). Culture is not static. Walsham (2002) discusses cross cultural interactions with globalizations in ICT development and use. Walsham focuses on the dynamicity of culture, intra-culture differences, work group culture as negotiated culture rather than looking culture as static and the changes that occur through time. He also stresses that the cultural differences are not only on the national level, there are also intercultural differences within a nation like for example in multi-ethnic societies. Walsham recommends that practitioners need some understanding,

and ideally empathy, for the attitudes, norms, and values of others which provide the possibility of mutual respect between cross-cultural partners and the opportunity for a move toward a more negotiated culture of cooperation.

However, UCD and usability evaluation deal with usually the interaction between practitioners and users and as a result focuses on the understanding of the culture of users and practitioners rather than cultural negotiations between equal groups as that of Walsham's discussion of negotiated culture. Furthermore, the study and analysis here focus on adaptation of methods to the context of users and developers where their socioeconomic and cultural characteristics need to be considered.

Usability is a measure of the extent to which prospective users are able to apply a system in their activities. Ethiopia is a multi-ethnic society. Cultural diversity and heterogeneity is another constraint to usability evaluation. Studying the social and cultural practices that could impact software development and use can benefit the effort towards adapting UCD and improving usability as method is practice pattern (Dittrich, 2016).

5. METHOD

Due to shortage of time to create the survey questionnaire from scratch, it has been chosen to adapt part of the survey from the one that has been tested out four years earlier in southern Italy (Ardito et al., 2011) (Ital-study), which in turn was adapting a survey by Bak et al. (2008) carried out in in Northern Denmark (Dk-study). The questionnaire used in Ital-study has been translated to English with the help of the authors of Ital-study. Several questions that address user involvement and participation have been added to the translated questionnaire. The survey has been tested first with colleagues at IT doctoral program of Addis Ababa University for checking the validity focusing on the user involvement and participation part, and thereafter by sending it to four software organizations located in Addis Ababa. Their feedback has been used to finalize the questionnaire. We further decided to triangulate the survey with interviews of selected companies that involved in the questionnaire survey.

Our goal was to identify a representative sample of the Ethiopian software industry. We have considered all kind of software development organizations: software with graphical interface, including mobile-based applications, web-based applications, development for customers or internal use. Most of the Ethiopian software organizations are based in the capital, where few have regional branch offices. We, therefore, constraint our sample to Addis Ababa. To locate software engineering companies in Ethiopia we used several sources. We started by sending the questionnaire to Ethiopian ICT Industries Association (www.ictet.org/) using info@ictet.org describing our objectives and consent. The association has about fifty member software organizations as one of the committee member confirmed. Only one organization replied. We, therefore, resented to personal contacts and exhibitor lists of the 2014 and 2015 ICT exhibition held at Addis Ababa to get contact information of potentially relevant companies. These companies have been first contacted by telephone to make sure that the company developed software. The questionnaire was sent to forty organizations. In three weeks' time, we have got about ten responses and a reminder email was sent. In many cases, it has also needed additional phone calls to remind the organizations. In the end, we got a total of twenty-six responses to our survey. Given the numbers of the ICT Industries Association, we estimate that we got responses from about half of the Ethiopian software industry. The surveyed organizations were requested for an interview after analyzing the questionnaire to help triangulate the result, and seven of them agreed to participate, among them four were from those claiming evaluating the usability of their software and three were non-evaluating organizations. The selection was based on the relatively higher number of organizations claiming to do usability evaluation, and as a result more number of organizations were considered from these organizations for the interview.

The non-evaluating organizations were also considered for the interview to get in depth data on why they are not taking usability evaluation.

The closed questions have been analyzed using quantitative analysis. The open questions have been analyzed using qualitative coding techniques, i.e. thematic analysis (Preece et al., 2015): Themes were identified from the responses to each of the open questions by the first author following a similar approach to grounded theory. These themes were then coded and categorized, and the categories have been used to further code each sentence. The second author reviewed and guided the analysis. The responses on the interview have been analyzed in a similar manner with the open questions of the questionnaire.

6. RESULTS ON USABILITY EVALUATION

The first group of questions concerned general information and profile of the companies. Most of the software organizations surveyed, i.e. 88%, are small size organizations with less than fifty employees as shown in table 1. 80% of the surveyed companies have less than ten years of experience in software development; 42% have only between one and five years of experience as shown in table 2. From the 26 surveyed organizations only three have between one hundred and two hundred employees. The number of employees in these three organizations is higher because they do not only develop software but provide also public services, such as billing for telecom or electricity using their software as a service (SaaS) product or providing networking and security services in addition to software development.

Table 1: Distribution across Organization Size

Number of employees	1-10	11-50	51-200	>200	Total	%
Evaluating organizations	8	6	-	-	14	54%
Non-evaluating organization	4	5	2	1	12	46%
Total	12 (46%)	11 (42%)	2 (8%)	1 (4%)	26	100%

Table 2: Distribution across Years of Experience in Software Development

Years of experience	1-5	6-10	11-15	>15	Total
Evaluating organizations	8	3	1	2	14
Non-evaluating organization	3	7	1	1	12
Total	11 (42%)	10 (38%)	2 (8%)	3 (12%)	26

6.1. Understanding of Usability Evaluation

The first focused question asked into the respondents was understanding of ‘usability evaluation’. The 26 answers have been coded into eight categories: ‘evaluation of usability’, ‘problem solving’, ‘usability definition’, ‘acceptance test’, ‘functionality’, ‘customer involvement’, ‘security’, ‘do not know’. As shown in Figure 1, six respondents provided an explanation of usability evaluation that can be considered correct. For instance, one respondent said: “Usability evaluation involves watching real people use a product (or prototype), and using what is learned to improve the product”. Another respondent answered: “Usability Evaluation is an evaluation performed to assess how suitable the user interface of a given system is to the end users of the product”. Five respondents provided definitions that we coded with ‘problem solving’. An example is “the evaluation of how much is the developed system used by the client or user; how much is the problem of the users solved by the system”. Three respondents gave explanation that could be read as usability definition. One of them wrote: “how well users can learn and use a product to achieve their goals”. Two

respondents provided definitions resembling acceptance testing. Two respondents defined usability evaluation as adequate functional coverage, for example, one response is "customer feedback on functionality and UI, incorporating customer input ..."

The answers indicate that usability evaluation was always understood as evaluating the system together with users. Analytical methods such as inspection and heuristics were not mentioned or indicated.

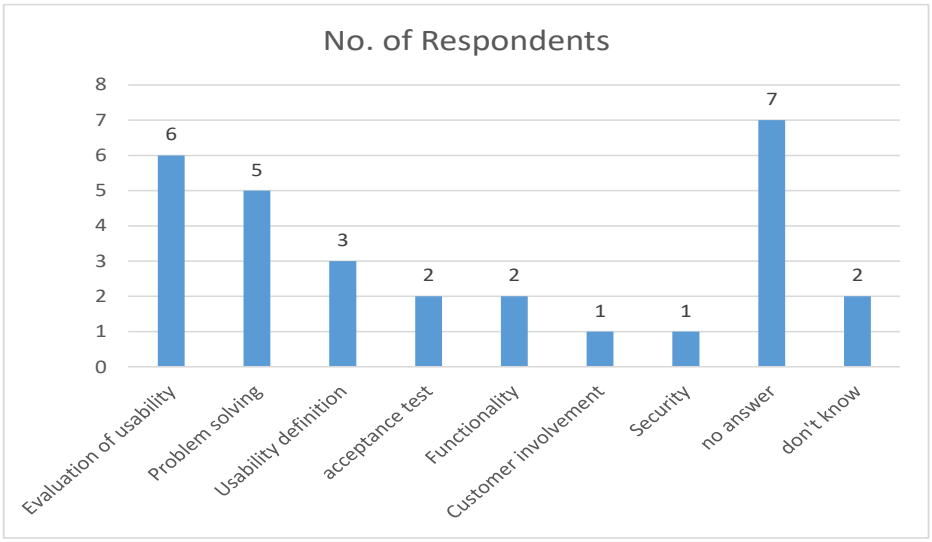

Figure 1: Respondents' Understanding of "Usability Evaluation"

6.2. Deployment of Usability Evaluation

From the 26 respondents, 54% of the organizations answer that they are performing usability evaluation while 46% are not performing usability evaluation.

6.3. Challenges in Usability Evaluation

The 14 respondents whose organizations perform some kind of usability evaluation were asked to report on the challenges they encountered. The responses grouped into the categories are shown in figure 2 along with the number of respondents under the category. The most frequently mentioned challenge by the respondents is categorized as '*Resource Demands*' followed by '*Lack of trained personnel*' and '*Developer mindset*'. In this paper we discuss the most mentioned categories of the challenges.

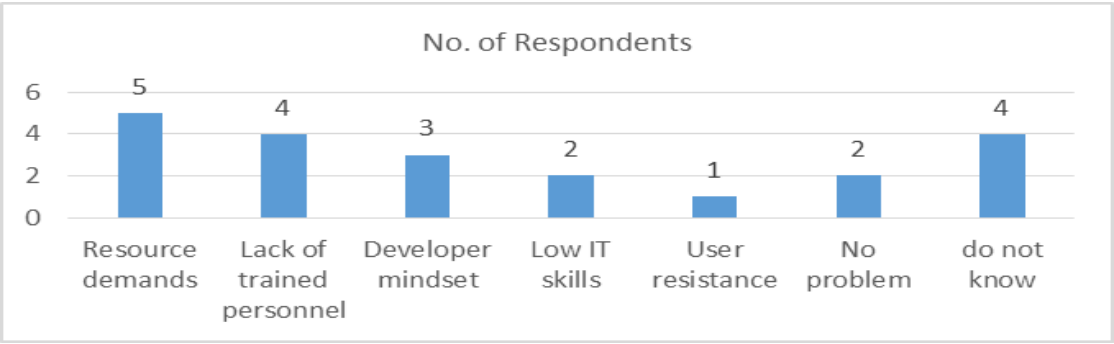

Figure 2: Challenges of Usability Evaluation

Resource Demands. Under this category, we subsumed answers that mentioned challenges related to time, personnel, individual preferences, and the heavy work that comes after the evaluation. Many of the respondents in the category said, it demands high resource

and personnel but without specifying how. One of the respondents under this category said for example: "it needs time and resources, there is no standard that we can negotiate, every customer has his/her preference that cannot be entertained". Some of the responses seem to indicate that usability evaluation is done in the final stage of development: "Usability evaluation requires resources such as dedicated man power and time to undertake. Sometimes the evaluation uncovers complicated usability issues and handling these requires extra effort." Similar views are also reflected from the non-evaluating companies.

The interview brought a more in-depth result and it presents 'lack of resource' as a challenge and is highly rated. A more articulated response we have got from the interview is: "Entertaining clients request and building based on their comments and feedbacks after some presentation of the working system take time and resource."

Lack of Trained Personnel. Four respondents in this category answered related to lack of skill and lack of awareness in usability evaluation by the developers; developers use the own experience to evaluate usability of the software, and lack of trained professional in the area. One respondent wrote: "There is lack of skilled people as there is also no HCI/usability professional" and another one is "lack of dedicated usability expert, usability evaluation is carried out by developers as additional task." This response might be attributed to the fact that Usability or HCI course is included in the modular curriculum of public universities late in the year 2014.

Developer Mindset. In this category, we listed answers such as "lack of interest from developer side to work with users", "using own assumptions to design user interfaces rather than practicing focusing on customer preference on user interfaces".

The interview study depicts the challenge in more depth. For instance, one interviewee said: "Developers want to do only what is needed based on their decision. Developers set of mind is the difficult condition to work with usability and they do not like to give time to communicate users because they consider it not important".

Categories of challenges mentioned by few but more contextual are *'low IT skill*' of the intended users or '*user resistance*' by one respondent each. Two subjects replied there is "*No problem*". Four subjects answered that they "*do not know*".

The interview study shows better in depth results. One of the interviewees responded: "Lack of usability skill and knowledge by developers…" and another interviewee responded: "We do not have specialized person working on it, developers are doing it from their experience in the software development". The rate of response in the interview responding '*lack of awareness on usability*' is high compared to the answers given in the survey. From the interview study, one can also understand that there is no specific usability evaluation method used in the companies. The RA/RI criteria (Bridges.org, 2005) set the need for human capacity and training, affordability of technology and economic situation among its twelve criteria for better ICT usage in developing countries. The challenges *low IT skills, lack of awareness* and *lack of trained professionals* reported here in this survey makes the challenges listed in the RA/RI criteria more visible.

6.4. Benefits of Usability Evaluation

The next questions for the respondents who said their organization carries out usability evaluation addressed the benefits of usability evaluation. Answers to this open question have been coded as: '*Ease of use*', '*Functional coverage*', '*User satisfaction*', '*Customer acceptance*', '*Quality improvement*', '*Resource saving*' and '*Do not know*' as shown in figure 3. In this article, we describe the most frequent categories.

Figure 3: Benefits of Usability Evaluation

Ease of Use. In this category, the responses are short and are not descriptive. One response is: "Reduce error, user-friendly and fully functional product which satisfies the needs of our customers." Another response is: "It ensures the system developed is friendly and easy to use".

Functional Coverage. Five respondents said that usability evaluation helped in meeting functional requirements and building a functioning product. The response might be due to lack of understanding about usability evaluation. One of them said: "It becomes a tool to gather missed functional requirements from users (as they usually comment on missed fields etc.)". Another respondent said: "The experts performing usability tests and assessments have required domain knowledge in the functional area for which the system is developed making it functionally sound".

Quality Improvement. Relatively many respondents are in this category. The respondents are also considering usability as one of the quality attributes. Few of the responses in this category are: "to make sure we are building the right product, to assess how users receive our products and it is a learning to incrementally improve value offered by our products"; "Better understanding of the needs of users, making solution suitable to users"; "building stable systems, better user feedback, low support visiting users".

6.5. Organizations Not Performing Usability Evaluation

12 of the surveyed organizations responded that they are not carrying out usability evaluation. For these organizations, four specific questions were asked. The first question was the reason for not performing usability evaluation. Most of these organizations reasoned that there is 'lack of awareness by the management and developers about usability evaluation' (10), 'lack of skilled personnel in the area of usability evaluation' is another reason (4), 'lack of resources and cost' (3). Three responded: "we feel not important". We relate this last response with that of the Ital-study and DK-study as "developer mindset", as it has been revealed during the interview session by the respondent as: "users have no other alternative currently, they can learn it, we have no fear of competitiveness and need to focus on functionality first that usability evaluation can be seen in future". This respondent is prioritizing functionality and usability can be addressed as other non-functional requirements possible later in the process. These responses match the challenges reported by evaluating organizations.

Only one respondent said that his organization is considering to introduce usability evaluations, possibly as activities assigned to external consultants, while, 8 replied "No" and 3 replied that they did not know. They were also asked if it could be possible to minimize the reasons they mentioned for not performing usability evaluations, eight replied 'Yes', one

replied 'No' and three replied 'I do not Know'. Finally, respondents were asked if they believe that the products of their company could improve by performing usability evaluations, nine replied 'Yes', one replied 'No' and two replied 'I do not know'.

7. RESULTS ON USER INVOLVEMENT AND PARTICIPATION

Surprisingly, user involvement is wider spread among the surveyed organizations than usability evaluation. 81% of the organizations responded "users are involved whenever it is necessary", and 85% of the organizations responded that they do involve users in their development projects. Below half of the surveyed organizations (46%) responded they practice early user involvement. The interviews revealed, though, that user engagement seems to come after deployment, as one of the respondents said: "The practice of user involvement is not mature. Users come or call for support as a complaint after delivery when they face difficulty on operations" and another respondent said, "Some users do not like to follow up the process, instead wants to see only the last workable version and may say 'this is not what I want' ". As one can understand from the responses to the question on the interview following the questionnaire on user involvement and on who the organization involve on the client side, the responses are mainly focused on initial phases during requirements identification with customer representatives assigned by the client and for acceptance testing and feedbacks on the final release with end users.

Organizations that claim to practice early user involvement were asked to describe what methods they use and the benefits earned as a result of early user involvement. The qualitative thematic analysis of the responses resulted in codes and categories: '*better understanding of user needs*' (75%), '*reduce cost*' (25%), '*users and developers will have common understandings*' (25%), '*develop only what is needed*' (17%) and '*increased user satisfaction*'(17%).

7.1. Challenges of User Involvement and Participation

To the open questions of the questionnaire on the challenges of user involvement, the responses are analyzed using the same process as the usability evaluation questions and categorized as: '*Users do not know their requirements*', '*Slows down development time*', '*Low IT skill of users*', '*Lack of user motivation*', '*Lack of customer collaboration*', '*Developers do not like to work with users*', '*Acceptance for change*', '*Cultural influence*', and '*Increased cost*' as shown in figure 4. Here only the most frequent categories and some of the challenges considered unique to the case are discussed.

Figure 4: Challenges of User Involvement

Under '*Users do not know their requirements*', there are eleven related responses and among the responses are: "Users may not know what they want, … without clearly providing their requirements want to see a finished product", another response is: "sometimes the expectation of clients and what can be done are different. Clients and users may not know their needs". Its high frequency might be associated with the few number of organizations practicing early user involvement as only 46% of the respondents claim for early user involvement. The triangulation interview also informs only informal techniques for early user involvement as only one of the interviewee claimed for example, using screen mock-ups to support developers understand user needs and using people with domain knowledge from the client side as customer representative, responded "screen mock-ups and low-fidelity prototypes practiced by the practitioners for their design but not for interaction with users, we use people with domain knowledge from the client side to represent users and support developers". Under the category '*Slows down development time*', there are seven responses among them are: "In most cases users do not convey their requirements properly, resulting in delays in project implementation", another more articulated response is: "users are most of the time able to clearly describe their requirements after a couple of presentations to them. This increases the cost and delays the project time". Seven respondents mentioned user involvement and participation challenge related to '*Low IT skill of users*'. A response related to this category and computer skills is: "Users are slow in testing and approving some features of products" and another related response is "Time taking to make users understand the IT part and requires more effort to teach users". Another category responded by six respondents is '*Lack of user motivation*'. Some of the responses in this category include "users are less willing to actively participate in project planning, specification and testing", and "… making users involve in software development is difficult as they have their own job and clients not aware of its advantage". The other more cited category is '*Developers do not like to work with users'*. Initially it was coded as 'developer mindset' but we preferred to keep it with more reflected meaning of the respondent as coded here. The other equally cited category with this challenge of user involvement is '*Lack of customer collaboration*'.

The categories found unique in the user involvement challenge are '*acceptance for change*' and '*cultural influence*' each responded by two respondents. The challenge '*acceptance for change*' as a respondent said it, "in some cases users are not confident to use technology until they see someone operating on it, so they need assurance, and they prefer to stay with what they already have in hand until they get it proved or well informed by others" and the other respondent's view is in connection with resistance to change situation as he said, "User resistance to change is the difficult situation, they do not easily cooperate with technical people to new change situations on their work". We were to categorize it in the category '*Lack of user motivation*' but we decided to keep it here as it gives more sense to this category. Similarly the hierarchical cultural impact has also been reflected as user involvement challenge, as for instance the response "…. users do not always directly tell their failure of operating a product to developers on time, they prefer to talk to their friends or their immediate assistant" which has been coded and categorized as '*cultural influence*'. The other response in this category is "users consider technical people can do everything by themselves and also they take the failure as their own problem of not able to operate; sometimes consider criticizing technical people in front of them as not normal". The user challenges: 'acceptance for change', 'lack of motivation' and 'cultural influences' are more reflected in the interview following the questionnaire.

7.2. Benefits of User Involvement and Participation

As discussed in section 2 in the related literature, user involvement and participation has positive impacts in system development such as increased sales, increased productivity,

decreased training, support and maintenance costs (Kujala, 2003). There are positive impacts of user involvement on system success (Bano & Zowghi, 2013).

From the questionnaire survey, the benefits of user involvement and participation in system development is coded and categorized as: '*understanding users and their needs*', '*better acceptance by users*', '*clearly identify requirements*', '*build usable products*', '*developing sense of ownership*', '*project completion on time*', '*quality improvements*', '*less rework*'. Figure 5 shows these categories.

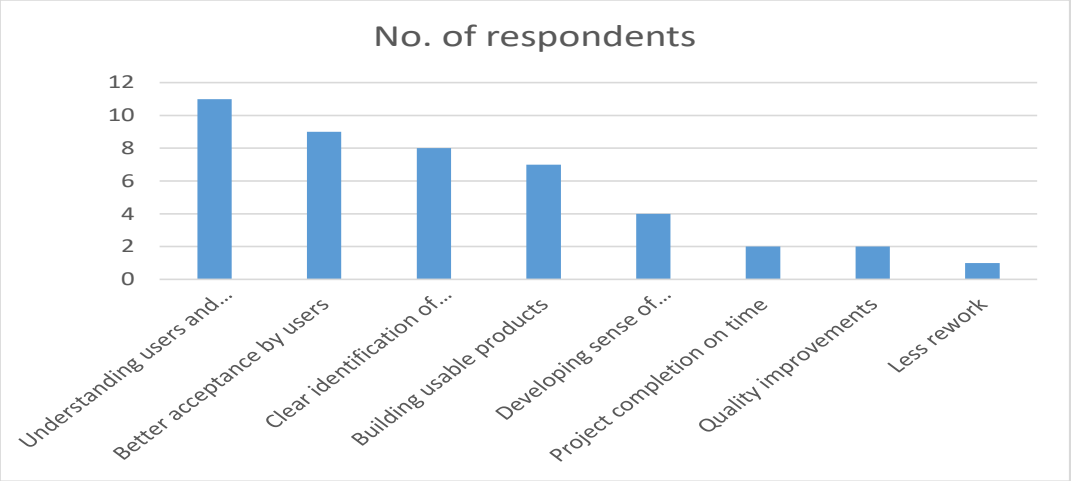

Figure 5: Benefits of User Involvement

The most frequently mentioned category based on the analysis is '*understanding users and their needs*' responded by eleven respondents. As the category is related to one of the principles of user centered design (UCD) aiming at improving usability, in the interview following the questionnaire, the interviewees were asked about their knowledge on following standards and principles like that of UCD referring to the ISO 9241-210:2010 (ISO 9241-210:2010, 2010). However, none of the interviewees claimed to refer such standards. As one of the interviewees indicated, interface designs are driven by experiences and adapting user interfaces that are developed earlier from other sources or their own products.

'Better acceptance by users' category has been responded by nine respondents. The themes that are coded to this category include "provides less resistant by users", "provide our company with a receptive mindset of clients that are eager to accept the system and use it for their needs", "lowers acceptance testing effort", "user acceptance test becomes manageable and successful" and the like.

For the other categories of the benefits of user involvement: '*Clear identification of requirements'* has been responded by eight respondents, '*Building usable products'* by seven respondents, and '*Developing sense of ownership'* by four respondents. Some of the themes and codes from the responses that grounded the category *to 'Building usable products'* are "Customers and users easily understand the system", "to develop easily learnable system", "build effective system", "reduce errors", and "to take corrective measures" that has also been associated with the analysis to the five attributes that Jakob Nielsen (1993) has used to define usability.

Even though only a few number of organizations claim for early user involvement (46%), a high number of organizations (85%) claimed for their involvement of users. This high number might be associated to the responses of the other questions in the questionnaire that users are contacted for information during requirement gathering or for feedbacks during operations or support requests. For example, to the question 'for what form of user involvement they are practicing', most of them responded to the *informative* category,

accounting 81% of the respondents as shown in table 3, and to the other question, 'enquiring in which phases of software development life cycle users contribute most', many of the subjects responded, 'in the requirement gathering', 'testing prototypes' and 'user acceptance testing phases' which account for 92%, 73% and 42% of the respondents in that order as shown in Table 4. In both tables 3 & 4, a respondent might choose more than one of the categories to each of the questions. The responses in table 4 might be associated with the response to the question enquiring about their development process at the first part of the questionnaire where the responses are Agile/Scrum/eXtreme programming (42%), Waterfall (38%) and Iterative or prototyping (38%). As the responses show more than one type of development process is applied in an organization.

Table 3: Form of User Involvement

Form of user involvement	Counts	Percent
Informative	21	81%
Consultative	14	54%
Participative	9	35%

Table 4: Responses to the Phases in which Users Contribute Most

Phases in software development	Count	Percent
Requirement gathering	24	92%
Interface design	6	23%
When testing prototypes	19	73%
Implementation phase	4	15%
User Acceptance test	11	42%
Operational use in reporting problems	12	46%

8. DISCUSSION AND CONCLUSION

We set out to investigate the state of usability evaluation practice in Ethiopia. The previous sections provide a number of interesting results. We here would highlight a number of aspects we find to warrant further research and discussion.

None of the responses in our survey mentioned a specific usability evaluation method or tool. During the interview session, only one of the subjects raised a discussion about using low fidelity prototypes. This is in similarity with the finding of Ital-study that none of their subjects presented a specific usability evaluation method, its challenge or benefit.

Looking at the response to the question asking into understanding of the term 'usability evaluation', two respondents wrote that they 'do not know' and seven did not respond to the question. We read these answers as an indication that the respondents were unsure about the definition.

The percentage of organizations performing usability evaluation in our case is low (54%). An interesting finding in the results is that the challenges of usability evaluation confirmed by the respondents in our survey include *lack of trained personnel* (by four respondents) and *low IT skill* of users (by two respondents). Additionally, lack of awareness has been mentioned frequently by the interviewees. These are usability evaluation challenges unique to the situation. None of these usability challenges have been mentioned by the Ital-study or DK-study. *Developer mindset* has been mentioned by four respondents in our survey and also *resource demand* as a challenge by five respondents in our survey.

Understanding of Usability. The predominant understanding of usability evaluation seems to be an informal one and, many answers indicate that usability evaluation is understood as evaluation with and by users. No usability evaluation method has been

explicitly mentioned in the survey answers. Also, a high percentage of respondents did not provide a definition of usability evaluation.

Lacking Skills. This is confirmed by answers to other questions: as one of the most often mentioned challenges for usability evaluation 'lack of trained personnel' was mentioned. Also, the 'developer mindset' and the lack of awareness among developers and managers indicate the lack of training. This is also supported by related research indicating that the organizations are at their early stages, small and inexperienced, follow ad hoc processes and methods, and are suffering under inadequate staff education and training (Biru, 2008; Dino & Bekele, 2012). HCI is not institutionalized, and the curricula at the public universities have included HCI only in the year 2014. The current practitioners in the industry are not the result of the nationally harmonized curriculum which has an introductory course of HCI in the computer science program of the public universities in Ethiopia, however, the course can bring improvements on skill and awareness levels.

Socioeconomic Context. The socio-economic context in which software engineering in Ethiopia takes place shows in the mentioning of specific challenges for usability evaluation: 'low IT skills' of users and 'end-user resistance' are also unique to the situation. This might also be the reason why, as the answers indicate, usability evaluation and also user involvement seem to take place after initial deployment. The lack of focus on usability in governmental procurement procedure in Ethiopia mentioned by our respondents and supported by (Aregawi & Lemma, 2013) mirrors similar shortcomings also in the developed countries (Ardito et al., 2014). However, the effects on the societal development and inclusion of heterogeneous users with partly very low IT literacy might be more problematic in Ethiopia as a low economic and developing country. The need to consider public support and policy for ICT development in developing countries has been also discussed in the RA/RI criteria (Bridges.org, 2005).

Real Access to ICT: access that goes beyond computers and connections so that technology use makes a Real Impact on socio-economic development. Lack of awareness and lack of skill by the users and lack of trained professionals on usability and HCI and furthermore lack of funds for projects responded by the subjects of our survey are all unique challenges that are not critically discussed in other literature which might make visible the challenges to the so called 'digital divide' that discriminates between those that haves and those that do not have and has been discussed in the RA/RI criteria (Bridges.org, 2005). The work and social activities in developing countries is not integrated with ICT that it needs more effort to make the people understand the advantage of using technology and its positive impact in their life.

Emphasis on User Involvement & Participation. To our surprise, practices of user participation and involvement were widely spread among the respondents. We can only guess the reasons here. Even if Hofstede's concept of culture is contested (Walsham, 2002), categorization might provide a first indication: Ethiopian culture is analyzed as a 'high collectivism', 'high power distance' and 'high uncertainty avoidance' culture (Hofstede, 2016). The user challenge coded as 'cultural influence', responded as "users are not comfortable to directly critic developers". The initial observation in the case organization also shows that users prefer to talk to their friends or their immediate assistant rather than talking their failure to operate the system to the developers. These challenges could be associated to the influence of hierarchical cultural characteristic called *power distance* (PD) by Hofstede that needs practitioners to look for systematic evaluation of their products and prototypes with users for efficient involvement of end users. Furthermore the user involvement challenge categorized as 'Acceptance for change' makes clear the influence of the high UA of the cultural characteristic empirically investigated by Hofstede (2016).

Research by Zewge confirms the existence of strong collective decision-making traditions (Zewge et al., 2015). As Zewge's work as well as several PhD theses (Biru, 2008; Kifle, 2014) indicate, the methods, tools and processes to support usability and UCD in Ethiopia might need to be adapted to the specific cultural context and societal challenges here.

Having understood these usability and user involvement practices and the challenges in the local situation it needs to get deeper understanding of the software development practice and use. Collective decision making practice should be investigated from the software development and evaluation perspective to bring changes to the method in practice supported with the concept of practice theory. As practice theory also discusses that software developers do not follow the publicly documented software development methodologies rather appropriate practices to fit their context.

Future Work. The survey presented here was implemented in the context of a PhD project on including UCD in agile development in Ethiopia (see also (Teka et al., 2016)). The article (Teka et al., 2016) is based on an initial case to take measures and solutions for the usability challenges resulted here as well as the detail findings of the case.

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